The Mechelecin

VOL. 11 MARCH 1952 NO. 4

THE SCHOOL OF ENGINEERING
GEORGE WASHINGTON UNIVERSITY

Another page for **YOUR BEARING NOTEBOOK**

How to keep a drill team from marking time

The swivel on a drilling rig has to carry the tremendous weight of drill pipe that's often three miles long. To carry this load while permitting the pipe to rotate as fast as 250 R. P. M., oil equipment design engineers use Timken® flat thrust bearings in the swivels. Due to line contact between rollers and races, Timken bearings have extra load-carrying capacity. True rolling motion and incredibly smooth surface finish of Timken bearings practically eliminate friction and wear. Costly breakdowns are prevented.

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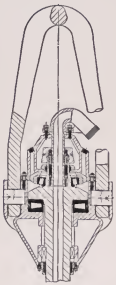
The Timken bearing used to carry the thrust load in this typical swivel is an on-apex thrust (type TT) bearing. A single-row (type TS) Timken bearing is used at the top position. Bearing adjustment is made with thin metal shims between the cup carrier and the swivel housing.



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Some of the engineering problems you'll face after graduation will involve bearing applications. If you'd like to learn more about this phase of engineering, we'll be glad to help. For a copy of the 270-page General Information Manual on Timken Bearings, write today to The Timken Roller Bearing Company, Canton 6, Ohio. And don't forget to clip this page for future reference.

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◎ AND THRUST —◎— LOADS OR ANY COMBINATION ✳

We hired an engineer over Berlin

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The steady growth of Boeing's Engineering Division over the past 35 years is an index of its stability. There's great work to be done here in all phases of aircraft design. Boeing engineers are now working on such truly exciting projects as the world's hottest jet bombers, the B-47 and the B-52; on secret guided missile programs, on the new Boeing gas turbine engine and other revolutionary developments.

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So plan now to build your career at Boeing after graduation. Salaries are good, and they grow as you grow. Boeing has present and future openings for experienced and junior aeronautical, mechanical, electrical, civil, electronics, acoustical, weights and tooling engineers for design and research; for servomechanism designers and analysts; for physicists and mathematicians with advanced degrees.

For further information, consult your Placement Office, or write:

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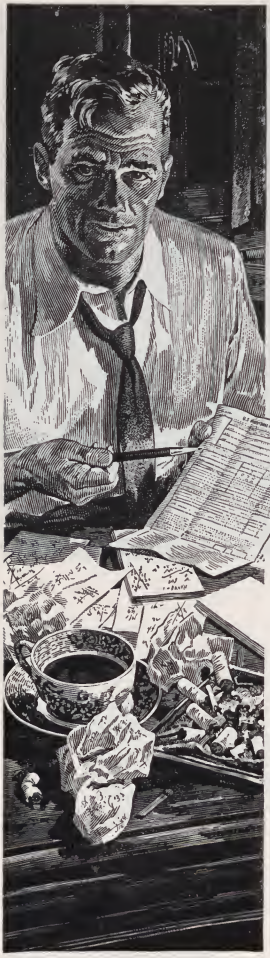

Here we go again!

"March 15th, Tax Day, is around the corner . . . and here I am, wrestling with Form 1040 again! You, too, I'll bet.

"Sure, I gripe about it *every* year. Who doesn't? It's like yelling at the umpire. Or beefing about the weather. That's our privilege!

"But this year's taxes really hurt. Now don't get me wrong . . . I *believe* in taxes. Can't run a government without taxes. And when it comes to our government spending money *honestly and efficiently* for Defense, Freedom or Good Government . . . it can have the shirt off my back.

"But down at the Republic plant I work hard for my dough. And, naturally, I get burned up when I read about a lot of money being spent *foolishly* by our government. That, of course, goes for all levels of government . . . federal, state, county and local. They're *all* run on our tax money . . . yours and mine.

"And when I say 'our' tax money, it reminds me that *companies* groan about taxes, too. *They've* got 'living expenses' same as we do, and taxes take an even bigger bite out of their income than they do out of ours.

"What's left of *our* pay, we call savings. What's left of a *company's* 'pay', is called profits. It is profits that create new jobs by improving and expanding industry. Without company profits, a lot of us citizens would *lose* our jobs.

"To get back to this business of *spending* . . . my wife runs our home with simple, sensible day-by-day economy. And so do my neighbors' wives. So does any well-managed business. So why shouldn't our government . . . national, state, county and local . . . practice that same common-sense economy, too? With, I repeat, *our* hard-earned dough!"

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Republic BECAME strong in a strong and free America. Republic can REMAIN strong only in an America that remains strong and free . . . an America whose vast Railroad Industry is unsurpassed. *And through railroading, Republic serves America.* Republic steel goes into track bolts and spikes . . . and into powerful locomotives that thunder over the tracks. Republic's famed Enduro Stainless Steel is found, inside and out, on gleaming streamliners that crisscross the nation. And in roundhouses and repair shops, tools and machines made of Republic steel help keep America's rolling stock rolling, come peace *or* war.

* * *

For a full color reprint of this advertisement, write Dept. H, Republic Steel, Cleveland 1, Ohio.

ON OUR COVER . . .

The S.S. United States is the largest and fastest passenger ship ever built in this country. Built at the Newport News Shipbuilding and Drydock Co. at a cost of $70,000,000, the giant liner was christened last June and is expected to make her maiden voyage in the early summer of 1952.

The peacetime capacity of the ship is 2,000 passengers with a 1,000-man crew but in an emergency the S.S. United States can carry 14,000 troops 10,000 miles without stopping for fuel, water or food. Thousands of gallons of fire-resistant paint will be used in finishing this ship.

—WESTINGHOUSE PHOTO

FRONTISPIECE . . .

Interior of the most powerful generating station in the world, The 2,000,000-kw Grand Coulee Dam and power plant.

Shown are the 108,000-kw water wheel generators installed in the plant. To meet demands several of the machines have run at overloads of about 130,000 kw for extended periods.

—WESTINGHOUSE PHOTO

The Mechelectiv

VOL. 11 MARCH 1952 NO. 4

ENGINEERING SCHOOL CALENDAR

MARCH

5—*Engineering Societies*, Government Building, 8:15
University Open House

12—*Theta Tau*, Monroe 203, 8:15

19—*Sigma Tau*, Government 201, 8:15

26—*Engineers' Council*, Conference Room, Building M

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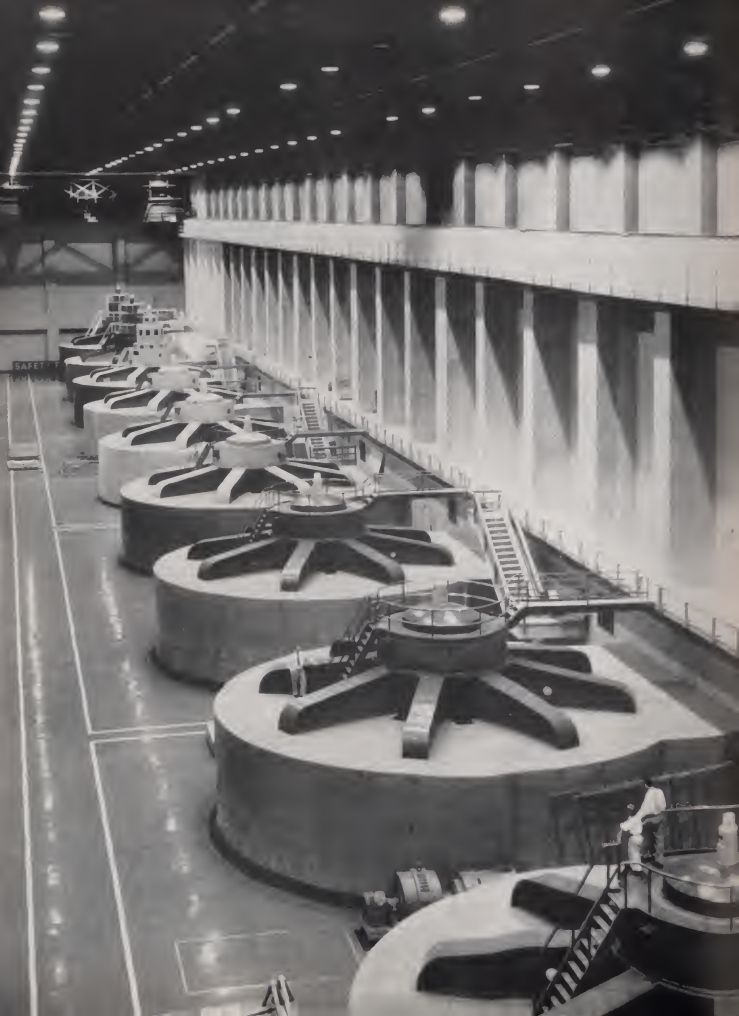

SAFETY

Half a Year . . . .

Benjamin Franklin once said, "Some indeed among us are not so much griev'd with the present State of our Affairs, as apprehensive for the future." Applied to the immediate affairs of the School of Engineering, if the future is dependent on the type of cooperation and school spirit that was prevalent the first half of this school year, being apprehensive will be an understatement. Sufficient extra-curricular affairs have been held up to this time to permit a determination of a general trend towards the support of such activities. Out of an enrollment of some 500 students, approximately 100 are members of the student branches of the professional engineering societies or engineering fraternities. This group contributes 75 to 100% of the attendance at the mixers, career conferences and the other "outside" activities. Why this apathy on the part of the majority of the engineering students?

The Engineers' Council has spent endless hours analyzing the engineering students' plight at G. W. and has been concerned with improving registration procedures, program scheduling for the maximum benefit of students and faculty, as well as certain entertainment which is intended to bolster morale and promote a little school spirit which is currently and noticeably lacking on the "Slipstick Campus."

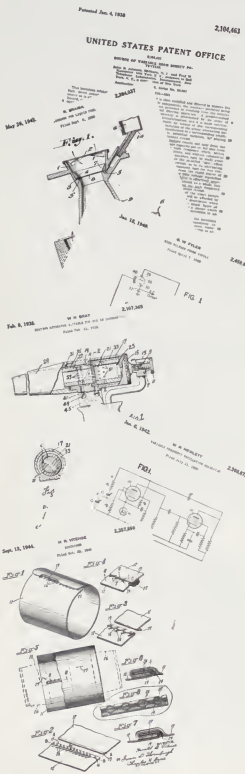
The results of these efforts have been disheartening. Only a few have found it convenient to come out for an evening of pleasure once or twice in a whole semester or to interest themselves in what the societies are doing.

What manner of success is a prospective engineer hoping to obtain if he cannot become a part of the organization to which he is physically attached? When he cannot exert himself sufficiently, for instance, to attend the career conference, which was well planned and executed, and specifically created for his benefit, how does he expect to be other than a "Dull Thud" with a degree? The world is becoming filled with men and women with college degrees, but having little else to offer. There is an urgent need, however, for people who can devote more time to activities outside their narrow little worlds, thereby enriching themselves by exposure to elements that have been created and intended for their mutual good.

We still have half a year to go. Whether the School of Engineering continues to be an example of near-ideal student-faculty and school relationships or becomes another obscure "diploma mill" depends on the support given in the future by the majority of the engineers.

Anticipate Your Inventions

by Willis L. Vary, BEE '51
General Motors Patent Section



One of the products of engineering effort is new ideas. The alert engineer should conduct his experiments in such a manner that the steps from ideas to inventions to patents shall be easy ones.

Since the words patent and invention are highly technical, perhaps some definitions will help. A definition of invention, as established by the patent law from the engineer's standpoint, reads, "Any new and useful art, machine, manufacture or composition of matter, or any new and useful improvements thereof constitutes invention." These terms are quite broad and frequently require interpretation by the court; therefore, seven definitions of invention in terms of court decisions are included:

1. One criterion of invention is that others have sought and failed, even where the process is so simple, when discovered, that many believe they could have produced it, if required.
2. The fact that a machine greatly increased the production over prior like machines is evidence that it was an improvement (and constituted invention).
3. An improvement in bowling alleys may appear so simple as to involve the mere application of common knowledge as to the law of gravitation, but the fact that the bowling alley makers had fully realized the defects in the old structures and for a long period of time endeavored to obviate the same in a variety of ways, none of which were satisfactory, and the further fact that the improvement has gone into very extensive use, are sufficient to resolve the doubt in favor of invention.
4. It is often difficult to draw the line between invention and mechanical skill (the former may be entitled to a patent, while the latter cannot be), but where a machine has achieved a success after a long line of failures, which accomplishes results never accomplished before, which has largely supplanted other machines in the market, it is generally safe to assert that the man who made it is an inventor and not a mere mechanic.
5. A new combination of old elements which made it possible to greatly increase the capacity of an electric transformer without dangerous heating and the value of which the public quickly recognized was held to involve inventive thought. The degree of labor and thought is unimportant, in view of the practical utility of the invention.
6. A new combination of old elements which enabled a riveting machine to accomplish several times as much work in a given time as any mechanism before in use and requiring less expensive labor to operate it, involves invention.

7. Where the inventor is the first to make a shunt having the plates of high resistance short (in length) so that the heat in them would be rapidly absorbed by the terminals, and the terminals massive so that they would radiate a large amount of heat rapidly, he has exercised invention of a very high and superior order.

One of the closest examples to the student is the use of the magnetron oscillator tube in radar. The tube was in existence for several years, but was impractical because it was so inefficient. The mere addition of straight wires strapping alternate poles together so that the strapped groups would be of the same polarity (causing it to operate in a manner similar to generator theory) increased its efficiency to a point of practicality. These definitions and examples should give you an idea of the difficulty of defining invention; however, the term patent is not equally evasive.

A patent is a legal monopoly granted by the government in return for a disclosure by the first inventor. This monopoly conveys to the inventor the right of preventing others from making, using or selling his invention. The monopoly endures for a period of seventeen years from the date of issuance of the patent (except design patents which are issued for 3½, 7, or 14 years depending on the fee paid by the inventor). With these definitions in mind we are alerted to the nature of the thing we seek; now let's proceed to the manner in which it is sought.

In the course of your experiments, you may reach a new solution of a problem. It may be a mathematical analysis of wave propagation which would derive a new type television antenna, or it may be a chemical equation which would produce a heretofore unobtainable compound. On the other hand, it might be a new method of manufacturing cement or a novel method of constructing a road bed. Such a solution may be new in the sense that it represents possible patentable invention. To properly obtain your legal right to the discovery, you must first swear that you are the first and sole inventor and then you must be prepared to prove the time at which discovery was made. This precaution is taken to prevent duplication of invention by two separate parties. Only the one who first conceived of the idea and reduced it to practice may receive a patent and this sometimes requires proof. In the case of two applications filed within a period of twelve months by separate parties for the same device, the Patent Office must decide who is the first inventor. To provide this evidence, a systematic notebook record of all experiments should be mandatory. Not only will the notebook represent proof as to date of conception of the idea but also as to the explanation of its operation and perhaps its subsequent reduction to practical application.

The following rules should prove highly helpful in keeping your laboratory notebook:

1. Keep an accurate daily account of your experiments.
2. Date each page and have it witnessed by two people who understand the experiment.
3. Make frequent drawings, sketches, graphs, or photographs, whichever is the most practical.
4. Do not change anything on the pages of the notebook.

We shall now study each of these rules in more detail. Use a bound notebook of standard size with its pages sewn in. Each experiment should be clearly defined and in logical order. Your experiments in school should provide a good skeleton around which to build the body, such as materials, apparatus, method, and results. They should be recorded in dark ink (in case a photostat need be made from the page) and worded in clear and concise language so that it may be understood by anyone skilled in the art. Include all facts which relate to the operation of the experiment; such as closely calculating all variables, and the range through which these variables were employed. These entries must be made daily for the very germ of an important idea may be forgotten or certain important facts might be slightly altered when entered at a later date.

Each page should be dated, numbered and witnessed by two persons not conducting the experiment who understand the operation. Should they be called upon to testify, they must be able to explain the working of the experiment in their own words. A recent invention was declared invalid because one of the witnesses was the inventor's wife who did not understand the technical operation of the invention. Should two or more persons working together create a device, the notebook must contain signatures of each, together with two additional witnesses. In law, the several cooperating inventors are considered an entity and cannot witness their own work.

Any pictorial representation strengthens the basis of argument for conception of invention. In the case of a chemical compound a color photograph might be very helpful. In electricity, a circuit or cross-sectional sketch of the device may be helpful. Each sketch or drawing should be dated, signed, and witnessed — it may be attached to the notebook by any convenient means. Sketches and drawings should have component parts numbered and an explanation should be made of their operation making frequent reference to the numbers.

Any additions or deletions render the notebook subject to question as to accuracy and time these changes were made. If a drawing is smeared, line through it and go on to the next clean page. If a word or sentence is wrong, line through and continue on the next clear line. Do not leave any blank lines at the top or bottom unless you draw lines through

(continued on page 20)

Air Conditioning Control Wiring

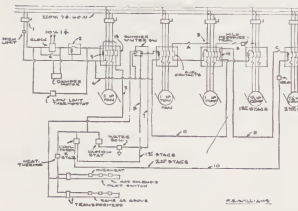
by Frank E. Williams, BME '51
H. W. Hottel, Inc.

The young engineer today is faced with the fact that just knowing his "major" is not enough. The dividing line between the different fields of engineering is obscure, and the engineer finds himself thumbing through dusty and nearly forgotten texts.

In refrigeration contracting for example, the mechanical engineer must make his own wiring diagrams and solve structural problems entailed in the placing of heavy equipment in addition to designing the mechanical systems which he feels are more in his line.

Nevertheless, wiring diagrams present an opportunity for the mechanical engineer to use ingenuity without concerning himself with wire sizes, motor characteristics, or any other details which may be delegated to an electrical subcontractor.

The author selected the accompanying wiring diagram because it covers a number of extremely important points in the control of refrigeration equipment, but does not entail the complexities of sub-zero refrigeration or close humidity control. Also, there are no mixing dampers or zone controls found in the larger buildings.



At the left is a disconnect switch (1) for the main control circuit. The high limit thermostat below, with its bulb in the return air duct, breaks the line if the temperature of the return air rises above 100° F. as in the case of fire.

The clock, with a weekend omitting device, makes and breaks the circuit to start the system in the morning and shut it down at night. The current flows from the clock, through the relay (2), pulling it in to make the solenoid circuit (3), which in turn pulls in the fan starter contacts. The damper motor across the load side of the clock will open the fresh air damper, but only if the load side of the clock is made. However, the manual switch (4), bypassing the clock, may be closed if personnel are working on the weekend or at night when the clock is keeping the circuit open.

The low limit thermostat, which also bypasses the clock, starts the fan if the temperature in the conditioned space drops below some arbitrarily taken temperature — say 55° F. But this circuit WILL NOT OPEN THE OUTSIDE AIR DAMPER because it is on the load side of the relay (2), and therefore current will not feed back through the open relay to the damper motor.

If this relay were not in the circuit, cold outside air would be drawn into the building, and this is not desired when the night or weekend temperature is down to 55° F.

With the fan on and the summer-winter switch up in the winter position, current flows through line 5, parallels through the two transformers, and returns through the switch to line 6. The auxiliary contacts at 13 prevent operation of the transformers if the fan is off. The heating thermostat makes and breaks the circuit with changes in the room temperature. On the load side of the transformers are two gas-fired duct heaters with manual pilots, gas solenoid valves, and overload cutouts. As the thermostat makes the primary, low voltage in the secondary opens the gas valve so that the unit will fire. If the pilot goes out or the overheat cutout is activated, either will open the circuit and the gas valve will close. In parallel with this circuit is the humidistat with its water valve. If the humidistat calls for moisture, it makes line 7, opens the water valve by activating the solenoid around the valve stem, and permits the current to flow back through the switch to line 6.

With the switch down in the summer position, current from line 5 will flow through the first stage of the two-stage thermostat, back through line 8, through the switch, through the tower fan pull-in coil, and back to line 6.

With the tower fan contacts made, current will flow from one of the hot lines at 9 through the auxiliary contacts in the tower fan starter, and back through the pull-in coil in the condenser water pump starter. With the pump operating, a similar circuit to that mentioned above starts the first stage compressor.

If the cooling from one compressor is not enough to satisfy the thermostat, the compound bar in the thermostat will make contact with another terminal which will make line 10. Current in line 10 will flow through the second stage compressor starter,

(continued on page 22)

OPEN HOUSE . . .

In conjunction with the University sponsored High School Day on March 5, the School of Engineering will hold its "Open House" for high school students, alumni, relatives, and friends of the School. All Engineers are being urged to attend with their wives, girl friends, family, and friends in an effort to demonstrate to the public that all college life is not in the classroom. The Open House will include tours through the laboratories, exhibits, experiments, and attendance of the regularly scheduled society meetings that evening.

High School Day has been a regular feature of the University during the winter semesters. Invitations are extended to the high school students of the Metropolitan area to come to the University giving them an opportunity to find out what college is like. The program consists of an introductory address by Dean Koenig, individual academic sessions for those interested in particular professions, and a tour of the campus.

For students aspiring to engineering the schedule has been arranged to correlate the two programs. Professor Antel of the Electrical Engineering Department will address the engineering forum ending the session with a question and answer period. Laboratory tours will be conducted in the early evening for exhibition of equipment. The different departments have planned specific exhibits and experiments which will graphically represent the purpose of the equipment and the practical experience which may be gained by their uses.

At 8:15 there will be a brief joint meeting of the four professional societies to welcome visitors, followed by the individual society meetings. The AIEE and the ASME have assigned that night to their Prize Papers Contests. The IRE and ASCE have scheduled speakers.

Here is not only a chance for all engineers to see what the other majors do in the labs but also an opportunity to invite the wives, girl friends, and parents to show them why the engineers never can make it out of the labs before eleven o'clock.

NEW COURSES . . .

Two new courses have been added to the Civil Engineering curriculum this semester.

C. E. 24, Elementary Photogrammetry, treats the history and development of photogrammetry; the fundamental principles, methods and instruments used in photographic surveying and production of maps. Particular attention is devoted to photographic interpretation and the principles of stereoscopy. The course is being taught by Mr. G. C. Tewinkle, U. S. Coast and Geodetic Survey.

C. E. 156, Prestressed Concrete, comprises a study of the theory of pre-stressed concrete with applications to the design of structures. The nature and properties of prestressed concrete and its advantages compared with ordinary reinforced concrete are discussed. Applications to circular structures, and the action of simple, continuous flexural members are treated. Tests are to be made of a simple prestressed beam. The instructor is Mr. Alvin R. Schwab, Bridge Department, Southern Railway.

The required curriculum has not been changed; these two courses are offered by the Civil Engineering Department as electives.

Shocking News

WATT? EE Prof admits with reluctance that his resistance has dropped and he is about to be transformed into a component of a couple. Hard to tell yet what the effect on the field will be. Yes, Cupid's closed the circuit.

CAREER CONFERENCE . . .

The Second Annual Career Conference of The George Washington University was held on February 20 with continuing success. The speakers for this year's principal forum were: Gen. Lewis B. Hershey, head of the U. S. Selective Service System, and Justice Robert A. Jackson, Justice of the U. S. Supreme Court. Following the main forum the participants broke up into groups representing their professional interests.

The Engineer's Forum remained in Lisner Auditorium where the main speaker was Mr. M. H. Trytten, Director of the Office of Scientific Personnel, National Research Council, who spoke on the growing shortage of technical personnel throughout the country. Seven other speakers constituted a panel who spoke briefly on their needs for engineers. The panel represented the Government—Army, Navy, non-military, and field services; large corporations represented by General Motors; smaller industries; and public utilities—represented by Potomac Electric Power Co.

In an effort to build enthusiasm in the metropolitan area, invitations were extended to fourteen local public high schools, seventeen secondary schools below the college level, Catholic University, and the University of Maryland.

REGISTRATION . . .

The School of Engineering's enrollment again shows that there is a departure of students from the school that once bulged at the seams with some twelve hundred students around 1946.

The many new incoming freshmen are showing that there will be a complete new academic generation untinged by military service signing up in the ROTC program for "Air Science and Tactics."

The School of Engineering enrollment is at present 530 students.

ALUMNEWS

We are beginning to hear a little more consistently from the alums lately. Some of them give us hell and some tossed in a compliment or two (not that we need them of course). ° ° ° *Tom Johnston*, BME '40, tells us he is (Quiet men!) a consultant CIVIL Engineer and Land Surveyor out in Fairfax, Va., address Box 293. He owns his own firm, called Fairfax Surveys and has enjoyed considerable success in this business in which he says it is necessary to have abilities as a lawyer, politician and salesman. He also enjoys reading MECHELECIV and wishes to be remembered to his friends among the alums and faculty. ° ° ° *Norman Miller*, BME '49, Hill Street, R.3, Bristol, Conn., gave us merry Ned because we didn't remember him to be a faithful subscriber. We will give you a little more info on ex-fellow student Miller when we can get it. Incidentally, our last letter requesting support from you alums was not directed at those who have been continually supporting the MECHELECIV. We know who you are and have always appreciated your interest and support.

George Kalv, BEE '47, 10 Pacific Street, down St. Augustine way, boosted our morale with his glowing praise of the magazine but would like to see the darn thing come on time for a change. (So do we, Bud!). By the way, what are you doing down there in our oldest city, George? ° ° ° *Bill E. Shephard*, BEE '49, 1114 Pinedale Road, Cocoa, Florida, is an Electronics Engineer at Patrick AFB, Fla., formerly NAS Banana River. (Ye Ed's olde stompin' ground.)

H. Velpeau Darling, BSCE '33, 3816 Lorcom Lane, way down in old Virginny says "good luck" as he applies for a life subscription. Vel has been standing by us ever since we can remember. ° ° ° *Ira K. Jones*, BEE '40, 200 Cabrini Blvd., NYC (Tempo) has been promoted from his job as Staff Assistant in the Plant Operations Engineer's Office, AT&T, New York, to District Plant Engineer in Cincinnati, Ohio. When I. K. graduated from G. W. he started out with the Washington Division AT&T. Don't forget to send in a change of address when you move to Ohio, Ira.

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Student Union Annex
The George Washington University
Washington, D. C.

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(Editor's Note: Include information about yourself and pictures; also comments on the magazine.)

° ° ° *Col. D. L. Dutton*, USA Ret., BSCE '13, CE '14, 192 S. College Ave., Newark, Delaware, thinks the MECHELECIV is always interesting and also wishes us "Good Luck." Thanks Colonel, we are still going to need it.

We have unearthed still more grads in the Navy Dept., Gad! won't the Navy take anyone else? Bob *Manville*, BME '51, is a Project Engineer with the Bureau of Aeronautics. He and *Dick Fenton*, BME '47, are doing some interesting work in the development of aircraft emergency arresting devices for the Navy for use on shore stations. ° ° ° *D. A. McBride*, BME '47, is also employed in BUAER somewhere. According to D. A. he was employed shortly after graduation as an Assistant Flunkie and has risen rapidly through the ranks to the unenviable position as Head Flunkie. Why the accent on the HEAD, Flunkie? ° ° ° *Woodie Armstrong*, BME '51, is a BUSHIPS engineer and is doing a commendable job on one of the Navy's newer hush-hush projects. Woodie has promised an interesting article on some of his work as soon as it becomes unclassified. "Maybe a scoop for MECHELECIV, too!"

Don't forget to send in a little info on yourself when you write in your complaints or compliments. We like to get your suggestions on how to improve the magazine, but we also would like to hear a little more about you too! It should be interesting to all concerned to know how *OUR* Engineers are making out and what goals have been attained since graduation.

Vincent Hennessy, BCE '49, on the part-time instruction staff of the Civil Engineering Department now has a life-time companion. Vince tied the knot with a local girl last December. So that's why he didn't show up for two class meetings before Christmas.

The Magazine wishes to extend its thanks to *Don Blanchard*, BCE '49, for the new furniture in the Engineers' Lounge. It is not only comfortable but has really decorated the wailing wall.

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LOCKHEED'S
great future

YOUR FUTURE

There's a better future—a better job—waiting for engineers at Lockheed Aircraft Corporation, in beautiful San Fernando Valley. At Lockheed you are well-paid from the start; work in modern, air-conditioned offices; receive training that prepares you for promotion—you are part of a team known for **leadership in aviation.***

These Lockheed planes show why Lockheed—and Lockheed engineers—earned that reputation for leadership:

THE VEGA—flown to fame by Charles Lindbergh, Amelia Earhart, Wiley Post.

THE HUDSON BOMBER—first American plane to fight in World War II.

THE P-38 LIGHTNING—first 400 mile-per-hour fighter-interceptor.

THE F-94—first all-weather jet interceptor assigned to duty with America's aerial defense forces.

THE SUPER CONSTELLATION—largest, faster, more powerful; the plane that bridges the gap between modern air transport and commercial jet transport.

The jet of the future—the plane you will help create—belongs in this frame. There will always be empty frames like this, waiting to be filled by Lockheed engineers. That's why Lockheed will always need forward-looking engineers. So why not make Lockheed's great future **your** future. See your placement officer for illustrated brochures explaining work—and life—at Lockheed.

If your placement officer is out of brochures, write

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LOCKHEED
AIRCRAFT CORPORATION
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***Aeronautical training is not necessary; Lockheed will train you.**

Only STEEL can do so many jobs

THE SINEWS OF DEFENSE are mostly steel, whether weapons, or steel mats, or the steel strapping that binds boxes of supplies. And for years, United States Steel has followed an uninterrupted program of expansion . . . so that it can produce ever-greater quantities of steel to help safeguard America's security.

NEW DELAWARE MEMORIAL BRIDGE, linking southern New Jersey and Delaware, will have an estimated traffic of 5 million vehicles a year. The bridge proper, with a total length of 10,765½ feet, contains the world's sixth largest suspension span, with a center span of 2150 feet. U.S. Steel products used include the structural steel, U·S·S AMERICAN High Tensile Wire for the huge cables, U·S·S TIGER BRAND Wire Rope and Universal Atlas Cement. The giant structure was fabricated and erected by United States Steel.

FACTS YOU SHOULD KNOW ABOUT STEEL

In the United States, there are 253 steel companies; 375 iron and steel plants. The payroll of the iron and steel industry in 1950 amounted to $2,390,000,000, and its approximate total investment to $6,750,000,000. The industry employs 635,000 people, exclusive of non-steel jobs, has 650,000 stockholders.

so well

FLOODWALL OF STEEL. 76 earth-filled cells like this, built of interlocking U·S·S Steel Sheet Piling, protect a Kentucky rolling mill against flood waters in the Ohio River Basin. Because of its great strength, long life, and low installation cost, this product of U.S. Steel is invaluable in all types of projects involving control of earth and water.

EASY WAY UP FOR A FAST TRIP DOWN. Skiers at Sun Valley find this "chairway" designed and built by U.S. Steel, a big help in mounting the world famous ski slopes of this popular Idaho resort. U.S. Steel's Tramway Division can design and build you anything from passenger tramways to freight tramways for transporting sand, gravel, coal, lumber, ore, limestone and many other materials.

STORY-BOOK DRAGON? No, this is a continuous miner, built to be highly maneuverable in a cramped, underground coal mine. With cutting bits mounted on electrically powered chains . . . it rips the coal from the seam face . . . and then conveys it automatically into transportation equipment for removal above ground. One of the wonders of modern invention, this powerful machine is made of tough, enduring steel. Only steel can do so many jobs so well.

This trade-mark is your guide to quality steel

Listen to . . . The Theatre Guild on the Air, presented every Sunday evening by United States Steel. National Broadcasting Company, coast-to-coast network. Consult your newspaper for time and station.

UNITED STATES STEEL *Helping to Build a Better America*

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WELL SUPPLY . . TENNESSEE COAL & IRON . . UNITED STATES STEEL PRODUCTS . . UNITED STATES STEEL SUPPLY . . *Divisions of* **UNITED STATES STEEL COMPANY, PITTSBURGH**
GUNNISON HOMES, INC. · UNION SUPPLY COMPANY · UNITED STATES STEEL EXPORT COMPANY · UNIVERSAL ATLAS CEMENT COMPANY

ENGINEERING PERSONALITIES

BOB SMITH

It is interesting to note that the personalities discussed in these columns are usually praised because of their accomplishments in the past, yet here is a fellow who also adds to the feats of his younger years the distinction of being a leading candidate for "engineer most likely to succeed". Bob Smith is known to students and faculty alike as quiet, modest and alert, and is one of the rare species of seniors with a QPI above 3.40.

Bob's existence began at East Orange, New Jersey some 22 years ago. At the tender age of six months he and his family emigrated to Brooklyn. Bob was roasting mickies (spuds to you), a sport of the younger set in Flatbush, one day, and decided on using a spot under the gas tank of a parked car for a stove. So — the Smith family hurriedly packed and went south. Bob's father was a member of the Soil Conservation Service and therefore covered a lot of ground. The Smiths ended up in the heart of the dust bowl, Amarillo, Texas, where he spent seven long years learning Texas arithmetic, Texas English, Texas and more Texas. His travels further carried him to Portland, Oregon; St. Louis, Missouri; and finally to Arlington. It is probably Bob's favorite decision that he transferred to Central High School in Washington for his last semester since it was there that he met his lovely wife, Barbara. After nearly four years of complete oblivion they were finally married on September 22, 1951.

Bob came to the University in 1947 as a part-time student to major in Mechanical Engineering. During the summers when he wasn't attending classes Bob worked at the Army's Engineer and Research Laboratories as an engineer aide. Here he worked on automatic course recording and map plotting instruments along with the development of automatic recording and plotting devices and miniature gyro-compasses.

He has also worked with mine detectors and path finder vehicles capable of plotting coast lines and profiles with automatic instruments at speeds up to twenty and thirty miles an hour.

Bob, who receives his BME in May, is a member of Sigma Tau, Theta Tau, and ASME; he is vice-chairman of both Sigma Tau and ASME.

Bob has, so far, three offers of employment from the Dupont Corporation, Sperry Instrument, and Goodyear. It is also rumored that Bob may be awarded a fellowship by the National Science Foundation.

MAYO-WELLS

W. J. Mayo-Wells, familiarly known as Mayo, is another fine example of a G. W. Engineering School graduate. Adding a cockney flavor to the February '52 graduation, Mayo, who was born in London, will receive his BEE with a communications option.

Educated at Radley College, Mayo continued his studies at the Faraday House Electrical Engineering Institute from which he received a diploma with honors in January, 1932. He is also a graduate of the General Electric Test Course and has held positions in electronics at Callenders Cable and Construction Company as the supervisor of a new cable-testing laboratory, and with Marconi's Wireless Telegraphy Company as a research engineer, first class, working on the development of high-powered broadcasting and shipboard transmitters.

During World War II Mayo served successively with the Tele-communications Research Establishment, Headquarters Anti-Aircraft in London, Headquarters of the Middle East Command, The Royal Air Force, and Headquarters of the RAF Bomber Command as an advisor on radio and radar airborne and ground equipment and installations.

In 1944 he joined the British Air Commission in Washington and later in August 1945 obtained a position with the Applied Physics Laboratory of Johns Hopkins University. Here he worked with a group devoted to mobile telemetering, principally for aircraft installations. He is still with the laboratory where he is in charge of the office responsible for the production and acquisition of telemetering information, and the evaluation of telemetering record automatic analyzers.

In 1948, Mayo founded the National Telemetering Forum, which, in two years, expanded to include over 200 organizations engaged in mobile telemetry in the defense program. The organization held forums throughout the country. Mayo presided over these meetings and presented technical papers at a number of them.

Mayo is an active member in AIEE and Sigma Tau. He is a Senior Member in IRE, a member of the AIEE Instruments and Measurements Committee, Measurements and Instrumentation Committee of IRE, Chairman of the AIEE Joint Subcommittee on Telemetering, and an active participant in other committees. He is also founder and first Chairman of the IRE Professional Group on Radio Telemetry and

(continued on page 22)

MIND OVER METAL . . .

It's just a bit of cold metal, this piece of printers' type . . . worth about 35¢ a pound. Yet it is the means by which an idea can be put on paper and spread a millionfold.

If America's printing presses were to stop, consider what would happen . . . to our educational system . . . to commerce . . . culture . . . communications . . . to civilization itself.

PROGRESS UNLIMITED . . .

We've come a long way from the printing techniques of the early Gutenberg 42-line Bible to the phenomenally fast presses of today. Thousands of craftsmen in the field of graphic arts have contributed to your education, enjoyment and enlightenment. Designers of hundreds of type faces. Researchers in metals, inks, paper and processes. And other skilled craftsmen utilize these materials and processes to bring you the printed word.

The Business Magazines to which men look for help with their jobs are an important segment of America's all-seeing, all-hearing and reporting Inter-Communications System.

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The McGraw-Hill business publications are a part of this American Inter-Com System.

As publishers, we know the consuming insistence of editors on analyzing, interpreting and reporting worth-while ideas.

As publishers, we know that advertisers use our business magazines to feature the products and services which they offer in the interest of increased efficiency, and lower production costs.

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McGRAW-HILL FOR BUSINESS

HEADQUARTERS FOR BUSINESS INFORMATION

• The Nominations Committee of Sigma Tau presented to the Fraternity on the 27th of February, a list of the candidates who are eligible scholastically to hold office for the forthcoming year. The election for new officers will be held at the next regularly scheduled meeting on Wednesday night, March 19th.

Plans are under way for the initiation and banquet which may be held on April 19th. An informal dance will follow the banquet.

Names of students eligible and recently pledged to Sigma Tau will be announced in the next issue .

• The principle speaker at the January meeting of the AIEE G. W. Branch was Mr. Dan J. Vaughan, System Planning Engineer for PEPCO who spoke on "System Planning of Public Utilities and its Problems."

March 5th has been set aside for the Prize Paper Contest. Contestants at this time will be: Roy Schlemmer, Murray Halperin, Jim Simpson, Larry Laubscher and Ed Wareham. Some of the topics to be covered are: "Gas Turbine Locomotives," Induction Heating," and "Transformer Cores." The winner may present his paper again in the Regional Conference Competition to be held in May.

• For personal reasons Ken Park has been forced to resign from his duties as chairman of the Student Branch. The Executive Committee, after a short meeting, voted in as the new chairman, Jim Beardsley, the past vice-chairman. The vice-chairman vacancy was subsequently filled by Ben Anderson who is also a representative to the Engineers Council from the AIEE.

On March 5th the IRE Branch will hear a talk on "Audio Systems Engineering" by a representative from the Naval Research Laboratory.

• The ASME student branch held an informal dinner and special meeting on February 27th to honor the president of their parent organization, Mr. R. J. S. Pigott. Mr. Pigott, a well-known petroleum and combustion engineer, spoke on "High Compression Engines."

On March 5th students will present papers for the Annual Prize Paper Contest. The winning paper will be presented later at the Regional Conference to be held at the University of Maryland. Also, the student having the winning paper will be permitted to compete for cash awards against Catholic U and the U of Maryland in a contest sponsored by the Washington Section of the Society. There will be three cash awards in this contest.

• A meeting of Theta Tau was held January 15th to present the new pledges to the Fraternity. The newcomers are: John Dodge, Bob Green, Jim Colangelo, Bob Chase, Paul Couper, Homer Musselman, Joe Gould, and T. S. McLaurin. Activities of the pledges began after their introduction and will continue until their initiation, Saturday, March 15th. On that night Theta Tau will hold its annual Birthday Banquet attended by many notable guests.

On the second of this past month members were treated to a stag party at the Cameron Club sponsored by the alumni of the Fraternity, and it turned out to be *quite a party*.

• Professor Carl H. Walther was the January speaker at the ASCE Student Chapter. His talk, "The Importance of the Engineering Society to the Practicing Engineer," revealed the benefits that not only the professional man may gain but also those that the aspiring student may derive from being a part of a professional engineering society.

Professor Walther also had the Society at his home in February for an informal get-together in lieu of the regular meeting.

The George Washington Branch will be host to the 100th Anniversary Spring Conference for colleges in the Washington area this year. Student members from Catholic, Howard, Maryland and Johns Hopkins Universities will wind up the conference with a banquet where they will be privileged to hear Rear Admiral Jos. F. Jelley, Chief of the Bureau of Yards and Docks, the guest speaker for the evening.

The guest speaker for the March meeting will be Mr. Ludwig on Civil Defense.

Security

A FAMILY had failed to make a living on a worn-out New England farm. Did they demand government subsidies, checks for crops they didn't raise, high prices for crops to be burned?

They would have scorned such things—scorned and feared, for they knew from days under a foreign despot that where government *money* goes, government *control* goes, too.

No, this family put everything they owned in that wagon, and *walked* beside it 2,000 miles, westward. They didn't know what was ahead, but they were determined to keep on going until they found a place of freedom where they could keep their self-respect.

They were English, Scotch, Dutch, Italian, French—people from many places—all, now, Americans. They knew that the only happiness is from self-respect, and the only way to self-respect is to earn your own way, not whine for something for nothing.

Their sons and grandsons started grocery stores, became mechanics, saved their money and started factories. American machines bought by American thrift made the factories grow.

And that's America. Made by people willing to walk 2,000 miles beside a wagon—to find opportunity. If such people are gone, if all we've got left are soft weaklings who want to be taken care of, then in truth American manliness is dead, that 2,000 mile walk was wasted, and there is nothing left of America but a hollow shell.

INVENTIONS . . . *(continued from page 9)*

the blank spaces to indicate nothing is to be written on them. If a change must be made on a completed page, make it on the next clear page and refer to the page on which this change is to take place.

If any question arises in your minds as to what you should include, it would be safe to consider any information valuable which would aid another person in understanding your device. It should be possible for anyone skilled in the art to read your notes, study your drawing, and have a thorough understanding of the discovery. Such complete information is invaluable in instances where the inventors are deceased, insane or otherwise incapacitated.

The next step is reduction to practice. In performing this step, the inventor applies due diligence upon the discovery until a stage of practical application is reached. In the case of a carburetor, reduction to practice would consist of installation in an automobile and conducting tests to prove economy, increase in power, and various other indications of improvement. Reduction to practice should also be witnessed and sworn to in order to be admissable as evidence.

We have successively followed the invention from conception to reduction to practice. The next step is one of application for a patent. This is an important one because there are several ways in which you might eliminate all possibility of receiving a patent. Some illustrations are as follows:

1. Publishing an article on your discovery more than a year before you apply for the patent. This also includes such related ideas as having your picture published together with the device or discovery in your local newspaper.
2. Putting a model or models into public use more than one year before application for patent.
3. Selling copies of the discovery more than one year before application for patent.

It is a popular misconception that maintaining secrecy over your discovery is one means of protecting its use. Such use in secrecy constitutes grounds of forfeiture in the eyes of the courts and the inventor so acting relinquishes his rights to a patent after one year of such use.

These pitfalls should illustrate the fact that the best protection of your invention is obtainable through a patent and the process of obtaining one should be set in motion as your idea has reached the practical application stage. In most cases even an application for a patent is considered as reduction to practice. By properly maintaining a laboratory record of your experiments, you anticipate the inventions, and are therefore prepared to take full advantage of your legal right to protection of these inventions.

Television joins the microscope in a major scientific advance, pioneered at the David Sarnoff Research Center of RCA, Princeton, N. J.

Microbes star on Television

in war against disease!

Until recently, scientists found it difficult to keep microbes alive for study—at high magnification—in light microscopes. Dyes, used to make them visible, killed some. Others were destroyed by the intense light.

RCA scientists have solved this problem by making television a working partner of the microscope. "Eye" of their new system is a tiny industrial television camera built around RCA's sensitive *vidicon* television tube. No intense light is needed, since this electron tube "sees" at extremely low light levels. And by making the tube sensitive to the red or violet bands of the spectrum, dyes and stains are eliminated.

With RCA's system, research men can watch living germs or cells—immensely magnified—on the screen of a television set. Many are able to watch at a time. Students can be more easily trained. And science *learns* more about disease by watching *live* micro-organisms.

Improving the microscope by teaming it with television is an example of the many paths explored by RCA Research. You benefit directly by better performance from any instrument or service of RCA or RCA Victor.

• • •

See the latest in radio, television, and electronics at RCA Exhibition Hall, 36 West 49th Street, N. Y. Admission is free. Radio Corporation of America, RCA Building, New York 20, N. Y.

CONTINUE YOUR EDUCATION WITH PAY—AT RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short-wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to College Relations Division, RCA Victor, Camden, New Jersey. Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION OF AMERICA

World leader in radio—first in television

AIR CONDITIONING . . . *(continued from page 10)*

back through line 11, through the auxiliary contacts at 12, and thence to line 6. If the contacts at 12 were not in the circuit, it would be possible for the thermostat to start the second stage compressor with the tower fan and pump off. Without the cooling tower water to condense the refrigerant, the compressor would overheat and probably blow its head off. Another safety factor is the HILO Pressuretrol which is mechanically in the suction line and electrically as shown. If the suction pressure drops too low, indicating a leak or absence of evaporation, the Pressuretrol will open the circuit. Conversely, if the pressure rises above a safe limit, indicating that the refrigerant is not condensing and re-evaporating, the Pressuretrol will break the circuit.

The manual switches at A, B, and C are not necessary, but they are helpful in trouble shooting and maintenance.

This is a typical year-round air conditioning control system. It is as automatic as possible which is almost a necessity in modern systems. With the sequence of controls as shown, tampering by uninformed occupants of the building can only result in stopping of the equipment. This would be the case if someone switched the system from summer to winter operation or viceversa. The only serious item in the switchover is cutting the gas cock off and on in the Spring and Fall, and lighting the pilot in the Fall. However, all good equipment has a metal plate with embossed instructions covering this item so that untrained persons can perform the switchover without difficulty.

The available units for a control system are few in number and quite simple. By using a little ingenuity, the engineer can design a system to control any type of heating or cooling system.

MAYO-WELLS . . . *(continued from page 16)*

Radio Control.

Mayo recently attended a symposium organized by the U.S. Air Force School of Aviation Medicine to study the physics and medicine of the upper atmosphere. He presented a paper on the aspects of telemetering to the problems of very high-flying aircraft as a part of a panel discussion of methods and vehicles for physical and biological research in the high atmosphere.

He married a graduate of Syracuse University, a Phi Beta Kappa, who recently received her MA in Education at G.W. Mayo has one son who is a junior at St. Alban's School.

What's Happening at CRUCIBLE

about tool steel forgings

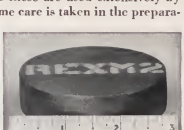
Whether 1½ pounds or 7 tons . . . forgings get the same sensitive handling

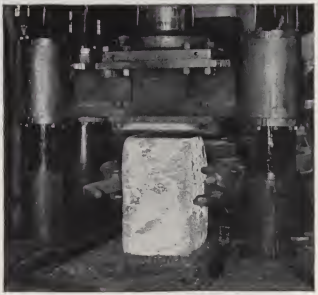
Crucible's reputation as the specialty steel leader is built on a devotion to the smallest detail . . . regardless of the size of the order.

These forgings are good examples of Crucible specialists at work:

Rex M-2 High Speed Steel Disc Forging (1½ pounds)

Pancake forgings such as these are used extensively by small tool makers. Extreme care is taken in the preparation of the slug stock. The upsetting insures proper flow lines. Milling cutters, gear shavers and similar cutting tools that require maximum toughness, coupled with the best cutting ability, are made from these forgings.





CSM-2 Plastic Mold Forging (14,000 pounds)

This CSM-2 plastic mold steel forging was made from a 25,000-pound ingot. This block will be heat-treated and worked to produce a mold for the manufacture of large plastic parts. The finished weight of the forging is 14,000 pounds. And it is the largest mold forging yet produced by Crucible.

Engineering service available

Crucible's engineering service is geared to meet your research and development problems. If you use special forgings, or any special purpose steel, check with Crucible. Crucible Steel Company of America, General Sales and Operating Offices, Oliver Building, Pittsburgh, Pa.

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National Drawn Works, East Liverpool, Ohio • Sanderson-Halcomb Works, Syracuse, N. Y. • Trent Tube Company, East Troy, Wisconsin

Build Confidence ON BROAD EXPERIENCE

by ARCH COOPER
Manager, Empire Region
ALLIS-CHALMERS MANUFACTURING COMPANY
(*Graduate Training Course—1909*)

YOU NEED the confidence that comes from wide experience, whether you intend to be a salesman, designer, researcher, or production man. Confidence based on knowledge is one of the greatest assets an engineer can have. Here is what I mean.

ARCH COOPER

You may visit a mine with the idea of talking about crushing equipment, but find that their engineers have an electrical problem. Or you may visit a utility to talk about electrical equipment and find that they're all excited about a pump break-down.

Offer All-Around Help

Can you help them? Or are you just another peddler who is taking their time when they have problems on their minds. In my work I call on electric utilities, cement plants, machinery builders, textile mills, paper mills, shoe factories and many other types of plants. In each of them, I try to help the engineers and mechanics I call on.

It's a good credo for salesmen, but it takes broad experience to carry it out. It's the kind of experience you must deliberately set about acquiring as early as possible. I had heard of Allis-Chalmers equipment, seen A-C's giant Corliss engines in Australia's biggest power plant and decided to study design at Allis-Chalmers. It looked like the best place in the world to get a broad engineering background.

Textile mills are getting adjustable speed at lower cost by using new automatic Vari-Pitch sheaves on spinning frames as shown.

High temperatures and speeds raise tough design and production problems on giant steam turbine spindles like these.

I joined the Allis-Chalmers Graduate Training Course after graduation from Sydney Technical College in 1908 . . . worked on steam turbines, wound coils of all types, performed tests for the electrical department. After that there were field trips to erect electrical equipment. It was soon apparent that I wasn't a designer at heart, and my sales career started.

Broad Opportunity

Forty-one years later, Allis-Chalmers still offers the same opportunity for broad experience. A-C still builds equipment for electric power, mining and ore reduction, cement making, public works, pulp and wood processing, and flour milling.

And the Allis-Chalmers Graduate Training Course is still flexible. Students help plan their own courses. They can switch to design, manufacturing, research, application, sales, or advertising—divide their time between shops and offices—and can earn advanced degrees in engineering at the same time.

Men at Allis-Chalmers get a close-up of the basic industries. No matter what path they take in the industrial world, experience gained with this broad organization lays a foundation for the confidence that comes with all-around knowledge.

ALLIS-CHALMERS

Allis-Chalmers Manufacturing Company, Milwaukee 1, Wisconsin

Engineering has a precision tool in photography

WHATEVER YOUR BRANCH of engineering, you'll find photography an increasingly valuable aid. With it you can picture lightning-fast operations—or extremely slow processes—at speeds suitable for study. You can capture fleeting instrument traces, study internal stresses in machine parts, examine metal structure and do countless other things.

The application of photography to engineering problems has become a specialty in itself. This has led graduates in the physical sciences and in engineering to find positions with the Eastman Kodak Company. If you are interested, write to Business and Technical Personnel Department, Eastman Kodak Company, Rochester 4, N. Y.

Here high speed motion-picture photography shows a cavity in a column of water produced when a 5-mm rod was shot through it at 12.2 meters per second. By taking the pictures at 3200 per second and projecting them at the standard 16 per second, time is "magnified" 200 times.

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